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Personality, self-control, and welfare-tradeoff ratios for revenge and forgiveness [Commentary]

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In this target article McCullough et al. present a fascinating view on revenge, forgiveness, and reconciliation. Whereas the existence of forgiveness in nonhuman animals may be controversial (and difficult to demonstrate), there is compelling evidence for revenge and reconciliation. In addition, the key function of revenge in imposing a retaliatory cost on aggressors has already been proposed for macaques (Aureli et al. 1992; cf. Clutton-Brock & Parker 1995). Thus, it seems that humans share both the form and function of revenge with other animals. Why then do McCullough et al. hypothesize that humans have evolved a cognitive system that implements the deterrence strategy, which they label a revenge system? Are McCullough et al. implying that animals, which show similar revenge patterns to those of humans, have the same cognitive revenge system? If so, humans did not evolve it but have adapted it from what a common ancestor already had in place. However, McCullough et al. are more likely implying that humans have evolved a unique cognitive system for revenge that is too complex for other animal species.

The revenge system presented in the target article is indeed complex. Whereas humans certainly have the cognitive abilities to implement such a system, is it really necessary to explain the majority of cases of revenge perpetrated by human beings? Couldn't a simpler mechanism based on emotional mediation be at the core of the patterns of revenge that have been reported for humans and other animals? There has been growing attention to the mediating role of emotions in humans (Frijda 1986; Panksepp 1989; Rolls 1995) and other animals (Aureli & Schaffner 2002; Aureli & Whiten 2003; Crook 1989; Lott 1991; Owren & Rendall 1997; Pryce 1996). An important function of emotions is motivating organisms to act (LeDoux 1996; Rolls 1990). In this respect, emotions interface between sensory inputs and motor outputs in a way that allows the individual to take a particular motivational stance (Aureli & Whiten 2003; cf. Tooby & Cosmides' [1990b] system of coordination), which then constrains its behavior for an appropriate amount of time (e.g., a longish period in the case of fear caused by sighting a snake; cf. Damasio 1994; Johnson-Laird & Oatley 1992).

The concept of relationship value is central to the forgiveness system hypothesized in the target article and to reconciliation between former opponents, as acknowledged by the authors. However, the expected value of social relationships does not need complex computation about the future. Most of our decisions are not taken based on improbable knowledge of the future, but are guided by probabilistic estimates based on past experience (Tooby & Cosmides 1990b). This is especially true for social intercourse as current behavior is affected, entirely or in part, by the individual's memory of past interactions (Aureli et al., in press; Hinde 1979; Seyfarth & Cheney 2012). The assessment of social relationships requires bookkeeping of the various interactions with the partner, computation of their relative frequencies, and conversion of their quality and associated information into a common currency. Such an assessment seems to be complex. However, emotions can play a critical role.

Emotional mediation has already been suggested to be at the basis of the assessment of social relationships (Aureli & Schaffner 2002). The emotional experience of an individual is certainly affected by the frequency and quality of previous interactions with group members (see Aureli & Schino [2004] for a review). Furthermore, emotional states may express a crucial integration of the information contained in the various interactions between two partners and may change over time depending on the interactions exchanged. The emotional experience can then be functionally equivalent to the aforementioned processes of bookkeeping, computation, and conversion needed for relationship assessment (Aureli & Schaffner 2002). The resulting emotional experience is partner-dependent. Thus, emotional differences can be at the core of the observed variation in social interactions reflecting the variation in relationship quality across partners.

Biological systems do not emerge *ex novo* as elegant solutions, but develop from pre-existing structures and therefore are

constrained by their evolutionary past. Humans have the abilities for complex computations as required by the proposed revenge and forgiveness systems, but they usually rely on evolutionarily older systems. Quick and accurate decision-making is based on the exploitation of how information is structured in the social environment mediated by emotions (Gigerenzer et al. 1999). Similarly, emotions can serve as somatic markers that allow rapidly rejecting or endorsing certain options based on the reactivation of emotional states associated with previous experiences and permitting the individual to efficiently make a decision (Damasio 1994; 1996).

When revenge spreads from the two opponents to family members, as in mafia vendettas, it seems more cognitively demanding because the individuals involved need to know about the relationships of others and the degree of similarity with their own relationships. Such family based revenge has already been reported in monkeys (Aureli et al. 1992; Judge 1982; Seyfarth & Cheney, in press). This suggests that even the cognitive processes underlying vendettas are not unique to human beings.

Personality, self-control, and welfare-tradeoff ratios in revenge and forgiveness

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Abstract: We address how trait self-control and trait concern for others relate to the concepts of monitored and intrinsic Welfare Tradeoff Ratios (WTRs), respectively, and how recent work on personality, revenge, and forgiveness are informed by the adaptationist perspective proposed in the target article. We also discuss how the proposed adaptationist perspective provides clues to some previously puzzling findings on revenge.

In the target article, McCullough et al. forward a timely adaptationist framework for conceptualizing revenge and forgiveness. According to this theoretical perspective, revenge and forgiveness are evolved psychological mechanisms that regulate the interpersonal behavior of a victim in response to the harm-doing of a transgressor. Central to their model is the mechanism of Welfare Tradeoff Ratios (WTRs) in conducting cost-benefit analyses of interdependent social behaviors. WTRs are psychological mechanisms that compute the relative welfare of a target's welfare compared to one's own welfare. In the target article the authors make a distinction between intrinsic and monitored WTRs. Intrinsic WTRs involve welfare tradeoffs that consider the indirect benefits a particular relationship has for the individual's own welfare, whereas monitored WTRs involve computations of a welfare-tradeoff taking into consideration the target's ability to monitor and respond to one's behavior. In light of this theoretical framework, we review recent research relating personality with revenge and forgiveness and suggest how this perspective may explain some recent unexpected findings in the literature.

Research suggests that forgiveness can be challenging, and that forgiveness is facilitated by the use of self-control – an ability to monitor and regulate behavior to achieve long-term goals (Balliet 2010; Pronk et al. 2010). Additionally, prior research has found that self-control increases the ability to positively weigh others' outcomes (i.e., WTRs) during interdependent social interactions (Balliet & Joireman 2010). Thus, self-control is not only

relevant for revenge/forgiveness, but may also affect the proximate mechanisms outlined in the target article, namely WTRs. Can the relation between self-control, forgiveness, and revenge be understood by the adaptationist model? Here we suggest that self-control may work together with evolved psychological mechanisms (e.g., WTRs) to affect revenge and forgiveness.

Specifically, individual differences in self-control may aid our understanding of *monitored* WTRs. People who monitor their behavior in relation to goals during social interactions, thereby exerting self-control, may be more thoughtful about how their own and other's current behavior may affect future outcomes. Another possibility is that self-control is used to compare other's perceived WTRs to one's own WTR, and this process may affect revenge and forgiveness. Although previous research suggests that self-control may enable people to inhibit their desire for revenge in order to maintain valuable social relations, as we discuss below, self-control can also enable people to become more vengeful. Other traits may relate to individual differences in the calibration of *intrinsic* WTRs (such as social value orientations; see Balliet et al. 2009). Importantly, both features of personality that affect monitored and intrinsic WTRs may interact to affect revenge and forgiveness.

Recently, Balliet et al. (2011a) measured intentions of revenge in response to a partner's initial transgression during an iterated prisoner's dilemma (and maximizing difference game). They found that trait self-control negatively related to revenge in response to their partner's defection, but only amongst individuals who were less concerned for others' outcomes, relative to their own outcomes (i.e., low intrinsic WTRs). In this experimental context, participants were thought to be interacting for several trials of the dilemma. One implication of this finding is that self-control may affect calculating concern for anonymous others, and especially in situations when another has an ability to respond and punish one's behavior. Certainly, in the context of each iterated game, mutual cooperation is in the long-term self-interest for both parties. Thus, self-control may be a general ability that works by adjusting (monitored) WTRs to manage social relations and achieve long-term outcomes for the individual. A second implication is that the effect of self-control on revenge may depend on a person's intrinsic WTR.

An unexpected finding in recent work is that positive intrinsic WTRs can lead to stronger revenge motivation in response to a perceived transgression, but only when people have the time and exert self-control to think about the costs and benefits of revenge (Balliet et al. 2011a; Perunovic & Holmes 2008). Perhaps high intrinsic WTRs establish expectations of social behavior that are easily violated, and self-control may initiate a comparison between own and an other's perceived WTRs that may subsequently encourage revenge in an attempt to get the other to recalibrate their monitored WTR to reach an equilibrium with their own. Yet, for individuals who have a low intrinsic WTR, the use of self-control may result in attempts to display an increase in their own WTR toward the other. Interestingly, in both accounts self-control may encourage strategies to reach an equilibrium between one's own and the other's WTR.

A second finding not easily explained by existing theories is that punishment more effectively increases cooperation when punishments are costly to deliver (Balliet et al. 2011b). Prior theorizing suggests that reduced costs of punishment make punishment more effective at promoting cooperation. Yet, this finding may indicate the importance of others' perceived WTRs for revenge and forgiveness. Not only do people possess their own WTR, but also cognitive mechanisms disposed toward understanding others' WTRs, and these hold important implications for both own intrinsic and monitored WTRs. Perhaps costly punishments communicate that punishment is delivered out of concern for the relationship or group and so may be more effective by simultaneously increasing the transgressor's own intrinsic WTR as well as the monitored WTR.

As we reflected on the ability of an adaptationist perspective to guide research on revenge and forgiveness, we noticed in several instances that this perspective could be meaningfully related to conclusions from our own research and is able provide clues to some previously puzzling findings. Specifically, trait self-control and trait concern for others may affect forgiveness by the calibration of monitored and intrinsic WTRs, respectively—a possibility that deserves future research attention. Overall, we are excited about the possibility of this model directing future research. Managing social relations certainly provided an abundance of challenges in our ancestral environment that were directly relevant to survival and reproduction. Taking revenge to deter harm and forgiving others to maintain vital social relations are likely two important ingredients that have enabled humans to successfully navigate the social environment.

Pathways to abnormal revenge and forgiveness

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Abstract: The target article's important point is easily misunderstood to claim that all revenge is adaptive. Revenge and forgiveness can overstretch (or understretch) the bounds of utility due to misperceptions, minimization of costly errors, a breakdown within our evolved revenge systems, or natural genetic and developmental variation. Together, these factors can compound to produce highly abnormal instances of revenge and forgiveness.

In the target article, McCullough et al. do an admirable job of arguing that revenge is not a disease, and instead may be an adaptation to prevent exploitation. This approach is long overdue in many social sciences, as it moves away from pejorative preconceptions about behaviours we don't like. As with any adaptive explanation for behaviour, there is a high risk of the authors' argument being misunderstood to claim that all instances of revenge should be adaptive. Such misunderstandings regularly occur with other evolutionary explanations of human social behaviour. As such, the authors' argument requires extension to examine when revenge and forgiveness will overstretch (or understretch) the bounds of utility, and why.

A complete explanation of revenge and forgiveness will include errors of absence as well as errors of excess. While there are popularized cases of ridiculous revenge, we often overlook the excessive "lack of revenge" or excessive forgiveness. These are the things that fill books like *Chicken Soup for the Soul*. They are potentially equally maladaptive, but we don't see them as "errors" because we "like" this behaviour (see also Wakefield 1992). There is likely an optimal level of revenge and forgiveness for any situation. Too little revenge is an insufficient deterrent, but too much revenge invites further retaliation (Barclay 2008). Too little forgiveness prevents reparation of a relationship, but too much forgiveness invites future exploitation (Axelrod 1984). Finding the optimal level of revenge involves "brinksmanship" (Daly & Wilson 1988), a difficult game when people have imperfect information about the world or about others' past and future intentions (e.g., Todd 2001). Because of such constraints, no evolved psychological mechanism is expected to produce optimal results in every single instance, but is expected to be adaptive on average (Haselton & Buss 2000; Nesse 2005; Barclay 2011). The following are some causes of excessive or insufficient